STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. 6812

Petition of Entergy Nuclear Vermont Yankee, LLC)
and Entergy Nuclear Operations, Inc., pursuant to)
30 V.S.A. §248, for a Certificate of Public Good)
to modify certain generation facilities)

PREFILED TESTIMONY OF ANDREW G. GREENE

I. Introduction

Q1. Please state your name and business address.

Response: My name is Andrew G. Greene. My business address is Navigant Consulting, Inc., 200 Wheeler Road, Burlington, MA 01803.

Q2. By whom are you employed and in what capacity?

Response: I am employed by Navigant Consulting, Inc. ("NCI") as Principal, Energy Markets and Operations, Energy Practice.

Q3. Please describe your current duties and responsibilities.

Response: I am responsible for providing consulting services in the areas of energy and environmental policy, regulatory compliance, strategy, and project development. I work with a wide variety of clients, both public and private, in most every facet of the energy industry.

Q4. Please summarize your educational and professional background.

Response: I received my Bachelor of Arts in Economics from Tufts University in 1983, and a Masters in Business Administration from Boston College in 1990. My work in the energy and environmental field began in 1985 when I started working at the Massachusetts Department of Public Utilities as an Economist in the Gas and Water Division. I was later promoted to Assistant Director and then Director, and had primary staff responsibility for gas and water cases and other matters pending before the Department, and managing the Division staff. I was appointed Assistant Secretary for Policy and Planning at the Massachusetts Executive Office of Environmental Affairs in 1991 and also served on the Massachusetts Energy Facilities Siting Board, and the Massachusetts Low-Level Radioactive Waste Management Board. At EOEA, I coordinated legislative and regulatory policy matters involving EOEA and its five line agencies. In 1995 I began work as an independent energy and environmental consultant, subsequently joining Navigant Consulting, Inc. in 1999, where I continue in this capacity. My resume is attached for additional information as Exhibit EN-AGG-1.

Q5. Have you previously testified in front of the Board?

Response: No.

Q6. What is the purpose of your testimony?

Response: I am testifying on behalf of Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. ("Entergy Nuclear VY" or "the Company") with regard to the economic benefits and costs associated with the proposed power uprate at the Vermont Yankee Nuclear Power Plant ("Vermont Yankee").

In particular, I address the allegations that potential costs associated with environmental externalities, plant reliability and health and safety margins outweigh any benefits of this project. As I demonstrate herein, the potential costs identified are marginal while the benefits of the project in the key areas of environmental quality, wholesale market impacts, and tax collections, are substantial. Additional qualitative benefits are also realized in terms of avoiding adverse health impacts from alternative generation sources and contributing to the success of recycling nuclear arms into commercial reactor fuel.

Q7. Please summarize your findings.

Response: This is an incremental analysis that considers only the economic effects related to the power uprate. The benefits identified in my testimony are substantial and vastly outweigh the potential costs. The uprate proposal clearly meets the benefit-cost criteria established in 30 VSA § 248(b).

II. Benefits of Uprate

A. Environmental Benefits

Q8. What are the environmental benefits that would result from the uprate?

Response: The uprate at Vermont Yankee will produce significant air quality benefits by avoiding air emissions from fossil plants that would otherwise be called upon to serve the New England grid. Nuclear plants, such as Vermont Yankee, produce electricity without emitting nitrogen oxides (“NOx”) sulfur dioxide (“SO_2”), particulate matter (PM) and mercury (“Hg”), carbon monoxide (“CO”) and volatile organic compounds (“VOCs). In addition, nuclear units do not emit greenhouse gases (GHGs), such as carbon dioxide (“CO_2”). Even though the New England grid has a number of non-emitting nuclear units and other non-emitting renewable resources (including non-emitting power imports such as Hydro Quebec) on most hours of most days, the marginal units dispatched to meet load (which also set market clearing prices) are fossil units burning coal, oil or natural gas. The Vermont Yankee power uprate, which will produce reliable baseload power across all hours and seasons, will reduce emissions from marginal units in the New England market throughout the year.

Q9. How can the air emissions avoided by the Vermont Yankee uprate be quantified?

Response: Each year, NEPOOL publishes a report called *NEPOOL Marginal Emission Rate Analysis*, which uses actual historical data and the PROSYM model to identify the marginal emissions rates over the course of the prior year. The most recent NEPOOL study published covered 2001, and is summarized below.

Table 1: NEPOOL Marginal Emission Rates (2001)

2001 Marginal Emission Rates (Lbs./MWh)					
Emission	On-Peak Ozone Season	Off-Peak Ozone Season	On-Peak Non-Ozone Season	Off-Peak Non-Ozone Season	Annual Average
SO_2	5.3	4.4	5.1	5.0	4.9
NO_X	1.9	1.5	1.7	1.6	1.7
CO_2	1,436.5	1,340.2	1,406.0	1,392.9	1,393.9

These data are compiled for the entire system. Although the report notes that the marginal units dispatched to meet New England loads are seldom those located in Vermont – only about 1-2% of the total New England marginal units' emissions would be emitted in Vermont -- there is still a strong argument that many of the avoided air emissions relating to the Vermont Yankee uprate would still benefit Vermonters given the regional transport of criteria air pollutants in the northeast, and of course, the global impact of GHGs released *anywhere* on the earth's climate.

There are other pollutants of concern to Vermonters not addressed in the NEPOOL study that would also be avoided by additional generation at Vermont Yankee. These include PM (both PM_{10} and fine particulates – so-called $PM_{2.5}$), Hg, CO, and VOCs. In the absence of a NEPOOL-specified marginal unit data, and given the increasing role of gas turbines in meeting capacity requirements, it is reasonable to use a large simple cycle gas turbine as a proxy for marginal emission rates of those pollutants *not* identified in the NEPOOL study.[1] This proxy produces the following emission rates:

PM_{10}	0.7 lb/MWh
CO	0.6 lb./MWh
VOC	0.95 lb./MWh

If anything, this proxy for a marginal unit would have lower emissions than the units determined (but not explicitly identified) by NEPOOL to be at the margin.

Q10. How much pollution in New England would be avoided by the Vermont Yankee uprate, assuming the use of the avoided emission values above?

Response: Company witness Thayer testified that following the EPU, he anticipates that Vermont Yankee will demonstrate capacity factors of between 96 and 98 percent during non-refueling years (every third year) and in the lower 90s during refueling years (assuming a refueling outage of up to 30 days). If one assumes that following the uprate the plant will achieve an average capacity factor of 91.7% (or a net

[1] Air emission for the large gas combustion turbine come from *Model Regulations for the Output of Specified Air Emissions from Smaller Scale Electric Generation Resources*, Regulatory Assistance Project, 2001.

output of 883,621 MWh per year), which was the average capacity factor for the entire U.S. nuclear fleet in 2002, and also reasonably reflective of Vermont Yankee's performance over the past several years, the uprate will avoid the following annual quantities of pollution:

SO_2	2,164 tons/year
NOx	751 tons/year
CO_2	615,840 tons/year
PM-10	309 tons/year
CO	265 tons/year
VOC	420 tons/year

Q11. What is the economic value of these emissions avoided by the Vermont Yankee uprate?

Response: Using the environmental externality values (in $2002) adopted by the DPS in connection with the existing Distributed Utility Planning settlement agreements, the following values are realized:

	DPS Value	VY Uprate Value
SO2	$0.679 / lb.	$2,938,712
NOx	$2.874/lb.	$4,316,748
CO2	$0.0095/lb.	$11,700,960
PM-10	$3.5125/lb.	$2,170,725
CO	$0.3832/lb.	$203,096
VOC	$2.3553/lb.	$1,978,452
	TOTAL	**$23,308,693**

Q12. Are there health effects for Vermonters associated with air emissions from power plants that would be mitigated by the Vermont Yankee uprate?

Response: Yes. In a recent study on the health effects of power plant emissions commissioned by the Clean Air Task Force (and performed by ICF Consulting, Pechan Associates, and Abt Associates)[2] it was determined that fossil-fired power plants impose significant, adverse health effects on Vermonters.

Table 2: Life-Cycle Emissions of Nuclear and Other Energy Technologies

Health Effect	Number of Occurrences per year for Vermonters	Potential Reduction of Occurrences per year due to Vermont Yankee Uprate (0.7% of total) [Navigant calculation]
Mortality	32	0.22
Total Hospitalizations	22	0.15
Asthma Emergency Room Visits	8	0.06
Chronic Bronchitis	22	0.15
Asthma Attacks	692	4.80
Lost Work Days	6,030	41.80
Restricted Activity Days	31,100	215.61
Deaths per 100,000 adults	8.6	0.06

Note: Vermont Yankee extrapolation based on 0.7% on New England generation. Navigant's calculation.

While the contribution of the Vermont Yankee uprate towards mitigating the health effects identified by the Clean Air Task Force report is likely to be very small, the postulated health benefits would be cumulative over the time during which Vermont

[2] See *Death, Disease and Dirty Power: Mortality and Health Damage Due to Air Pollution From Power Plants*, Clean Air Task Force, October 2000. http://www.catf.us/publications/reports/Death_Disease_Dirty_Power.pdf

Yankee remains in service. The key conclusion is that there are serious health effects for Vermonters from air pollution emitted by power plants in the region, and the Vermont Yankee uprate will play a valuable, if small role, in mitigating such effects.

Q13. Are there any additional societal or environmental benefits relating to the uprate that are not reflected in the market?

Response: Yes. As part of the historic 1993 United States-Russia Nonproliferation Agreement, the two countries agreed to a substantial reduction in the number of nuclear weapons and to convert highly enriched uranium (HEU) taken from dismantled Russian nuclear warheads into low-enriched uranium (LEU) fuel for use in U.S. nuclear power plants. Since the inception of this agreement, approximately 6,000 nuclear warheads have been eliminated and used for beneficial power generation purposes in the United States. When this program ends in 2013, a total of 20,000 nuclear warheads will have been converted into commercial reactor fuel – enough to power the entire United States for about 2 years. In a small, but meaningful way, the uprate of power at Vermont Yankee will contribute to the success of this "Megatons to Megawatts" nonproliferation initiative.

B. Tax Benefits

Q14. Mr. Sherman on behalf of the DPS testified that the expected incremental state property tax that would result from the Vermont Yankee uprate would be $414,120 using a ten-year average capacity factor. Do you agree?

Response: No, I think his figure is overly conservative. The recently revised property tax legislation affecting Vermont Yankee is now based on a per-MWh assessment formula, rather than the prior assessed valuation method. The new legislation uses a three-year average of the plant's net output to determine the tax obligation of Vermont Yankee. Because the new taxation method is based on output, the exact amount of incremental revenue is dependent on the operation of the plant, as reflected by the capacity factor. Given the full requested uprate of 110 MW and a range of potential capacity factors that may occur, the table below shows the incremental tax revenues provided by the uprate.

Table 3: Estimated Property Tax Payment by Vermont Yankee, By Capacity Factor

Capacity Factor	Tax on Existing VY Plant	Tax on VY with EPU	Incremental Tax due to EPU
89.1%	$4,500,000	$4,914,120	$414,120
91.7%	$4,500,000	$5,010,770	$510,770
95.0%	$4,530,512	$5,133,441	$602,929
98.0%	$4,622,991	$5,244,960	$621,969

Note: Assumes that average annual capacity of the existing unit is 510 MW net and that uprate provides another 105 MW of net average annual capacity. The 105 MW figure is based on the ratio between the maximum net capacity of the existing unit (530 MW) and its actual average annual net capacity of 510 MW.

Mr. Sherman voiced a preference for using a 10-year average capacity factor of 89.1% to compute the expected property tax collections. Figure 8 of Mr. Burns' testimony shows a different picture. The three-year capacity factor average for the period ending 2002 is approximately 93.1. As noted earlier, the U.S. commercial nuclear industry achieved an overall capacity factor of 91.7%. With a clear trend towards improvement in capacity factor, Mr. Thayer testified that attaining a capacity factor of between 96 and 98 percent is possible in a non-refueling outage year. Within this fairly wide range of potential capacity factors, the low end espoused by Mr. Sherman is too conservative. It is more reasonable to assume that the incremental property tax due to the uprate should, at a minimum, average in the upper range of the above-table, *ie,* above $550,000.

C. Impact on Market Prices

Q15. What is the effect of the Vermont Yankee uprate likely to be on prices in the New England power market and for Vermont distribution utilities, in particular?

Response: As Dr. Lesser testified previously, and as confirmed by Witness Oppel in her prefiled rebuttal testimony, there is every reason to expect that additional supplies, coupled with the realities of transmission system planning and pricing, will introduce downward pressure in the market. Lower market prices are of obvious benefit to buyers, whether wholesale or retail.

D. Summary of Benefits

Q16. Please summarize the total benefits that the Vermont Yankee uprate would provide to Vermont and its residents.

Response: The direct monetary benefits associated with the uprate are the additional state taxes tied to expanded generation output. Additional tax collection attributable to the uprate should be in the neighborhood of $550,000 to $600,000.

Further, the wholesale market prices in Vermont will likely experience downward pressure from the uprate.

The environmental benefits, though largely avoided externalities, are quite substantial when viewed in financial terms according to the DPS externality values. My calculations above indicate an externality value of $23.3 million annually.

The ability of the uprate to avoid air pollution and related health effects to Vermonters is also quite significant although difficult to ascribe a financial value. Similarly, the proposed power uprate is consistent with the non-proliferation initiative. Finally, by providing emission-free generation in Vermont, the uprate can help maintain compliance with air quality standards, and avoid possible constraints on transportation funding and economic development that could result from non-compliance with Clean Air Act provisions.

III. <u>Quantification of Incremental Costs</u>

Q17. Are there any public health consequences and costs associated with the 3.6 millirem per year dose increase at the fenceline that is estimated following the uprate?

Response: No. Witness Thayer states that the uprate will result in a maximum dose increase of 3.6 millirem per year at the Vermont Yankee fenceline. Even with this small increase, the Company will remain well below the 20 millirem standard contained in the Vermont Health Department's regulations.

According to Witness Auxier, the assertion by NEC Witness Gunderson that there is a linear, non-threshold relationship between radiation exposure and health effect at levels below applicable regulatory standards is wrong. Witness Auxier notes that there is no known risk associated with doses even as great as natural background radiation, which is far in excess of the incremental dose increase posed by the uprate. Consequently, Witness Auxier concludes that the 3.6 millirem dose increment is so far below the level of known risk that it "makes no sense whatsoever to associate an economic cost with it." Accordingly, because there is no known risk associated with expected maximum incremental radiation dose increase resulting from the uprate, no societal cost can be attributed to the increase.

Q18. In his testimony, Witness Sherman identified the increase in radioactive waste from the uprate as potentially imposing a "societal cost" that should be accounted for when considering the avoided environmental costs achieved by power uprate. Is radioactive waste a "societal cost" that should be factored into the benefit-cost test?

Response: No. Costs imposed by handling and storage of nuclear waste are borne directly by the nuclear industry as market costs – they are not "societal costs". Pursuant to the 1983 Nuclear Waste Policy Act, the Secretary of DOE levies a fee of $1.00 per MWh on all commercial nuclear plants to fund the long-term costs of managing radioactive waste in the federal Nuclear Waste Fund. Through the end of 2002, this fee has resulted in the collection of $22 billion – and the funding mechanism continues in force.

In contrast, air pollution regulation generally confers upon industry the right to pollute (in the form of allowances or emission permits) at no cost. Thus, this type of pollution is properly considered an "externality" whereas nuclear waste is not.

As to the argument that the generation of additional nuclear waste will present public health and safety risks that somehow offset the substantial air quality benefits provided from the uprate, Witness Sherman's testimony is instructive:

> "Since the NRC exposure limits will not be modified as a result of the proposed uprate, and since the incremental additional waste generation will be small compared with the radioactive waste that already exists, the societal costs associated with additional radioactive waste generation from power uprate is small and not a significant consideration for the 248 criteria."

This unambiguous testimony undercuts attributing sufficient weight to alleged "externalities" of nuclear waste generation associated with the uprate such that they would offset significant avoided greenhouse gas emissions. Even Witness Sherman calculates that the avoided emissions have an externality value of approximately $8.6 million (in 1989 dollars) [19 June 2003 transcript, page 197, lines 7-23]. Mr. Sherman noted that he "rather simply in rough fashion assumed it's a wash." In my view, simply setting aside the significant value of avoided emissions regarding the Vermont Yankee uprate in a "wash" is neither supported by the record, nor Mr. Sherman's own testimony.

Q19. Are there other externalities that might eliminate the environmental benefits attributed to the power uprate?

Response: I do not believe so. As previously noted, Witness Auxier attributes no economic value to the increase in radiation exposure due to the uprate. Further, no societal cost should be attributed to the incremental increase in nuclear waste generation.

Additionally, analysis of various "life-cycle assessments" shows that emissions from generation of nuclear power are the lowest among competing sources of generation. Upstream and downstream emissions relating to manufacturing/constructing the generating facility, producing fuel, transporting fuel, and eventually retiring the facility are not unique to nuclear power. Numerous studies regarding life-cycle emissions have been conducted across the energy technology spectrum. Summary findings of one such study, used by the International Energy Agency (IEA) are presented on the following page. The data illustrate that nuclear power emissions when viewed on a life-cycle basis are among the lowest per KWh when compared to all currently available energy technologies. Another useful reference point on this subject is the "ExternE Project" of the European Commission, which rigorously evaluated environmental, public health, and safety externalities of various energy technologies and also rendered very favorable judgments regarding the life-cycle impacts of nuclear power relative to renewable and fossil alternatives. *See* http://externe.jrc.es/reports.html for reports prepared for each one of the European Commission member countries.

Table 4: Life-Cycle Emissions of Nuclear and Other Energy Technologies

Generation option	GHG emissions gm/kWh	SO_2 emissions mg/kWh	NOx emissions mg/kWh	NMVOC mg/kWh	Particulate matter mg/kWh
Nuclear	2 - 59	3 - 50	2 – 100	0	2
Hydropower	2 - 48	5 - 60	3 – 42	0	5
Wind	7 - 124	21 – 87	14 – 50	0	5 - 35
Photovoltaics	13 - 731	24 - 490	16 – 340	70	12 - 190
Biomass (forestry waste)	15 - 101	12 - 140	701 – 1950	0	217 -320
Gas (combined cycle)	389 - 511	4	13 – 1,500	72 -164	1 - 10
Coal (new)	790 – 1,182	700 –32,321	700 – 5,273	18 - 29	3 - 663

Source: ***Hydropower–Internalised Costs and Externalised Benefits*; Frans H. Koch; International Energy Agency (IEA)–Implementing Agreement for Hydropower Technologies and Programmes; Ottawa, Canada, 2000.**

Thus, when accounting for a broad spectrum of potential externalities, there is no basis for discounting the substantial annual environmental benefits achieved by the power uprate.

Q20. Witness Burns testifies that the uprate at Vermont Yankee will increase the risk of Core Damage Frequency (CDF) event by 3.16E-7/yr or 4.1% from existing levels and that the increase in risk of a Large Early Release Frequency (LERF) event is 1.17E-7/yr or 5.3% from existing levels. Do these risk increments pose an additional societal cost that should be quantified?

Response: Yes, although they are nominal. As Burns testified, these risk increments are far below the NRC acceptance guidelines (Regulatory Guide 1.174) and constitute probabilities that are sufficiently low as to be considered "remote and speculative." In lay terms, the change in probability of a CDF event due to the uprate is a 1 in 3,164,557 additional risk each year and the change in probability of a LERF event due to the uprate is a 1 in 8,547,008 additional risk each year. Although such *de minimus* probabilities are even <u>less</u> likely than a "meteor strike causing world-wide havoc" (Burns Testimony, p. 24) they are nonetheless measured probabilistic values, associated with severe events that may have significant potential costs. On a statistical basis, these probabilities can be multiplied by the estimated cost of CDF event[3] or LERF event[4] events, yielding an expected value. I believe that such inquiry is warranted to assess potential cost impacts associated with a change in risk levels from the uprate, even if the change in risk falls within a range the NRC describes as "remote and speculative."

The costs associated with a CDF event or LERF event are site-specific values that typically are calculated pursuant to National Environmental Policy Act's (NEPA) Environmental Impact Statement requirements during the course of operating license renewal applications to the NRC. Vermont Yankee, whose operating license runs through 2012, has not calculated these values, nor has it been required to do so. As a very rough proxy for such costs at Vermont Yankee, I have used the figures submitted in the Quad Cities (Illinois) License Renewal Application, Appendix F, Severe Accident

[3] CDF is a risk measure for calculating the frequency of a severe core damage event at a nuclear facility. Severe core damage is defined as the uncovery and heat-up of the reactor core to the point at which prolonged oxidation and severe fuel damage is anticipated, involving enough of the core to cause a significant release.

[4] LERF is a risk measure for an offsite release that is high in fission products magnitude and early in release timing. A high magnitude radionuclide release is defined as having the potential to cause early fatalities, in which minimal offsite protective measure can be implemented (e.g. less than 6 hours from accident initiation).

Mitigation Alternatives. I selected this particular plant because each of its two units is a GE Boiling Water Reactor (like Vermont Yankee) of similar vintage as Vermont Yankee, in a location with comparable population densities within a 50-mile radius, although each unit at Quad Cities is significantly larger (855 MW vs. 530 MW) than Vermont Yankee.

Cost of a Severe Accident

Table 5: Quad Cities Nuclear Power Station, Unit 1 (Cordova, Illinois)

CDF (per year)	2.2E-6
Population (50 mile radius)	700,677
Off-site exposure cost	$733.84
Off-site economical cost	$615.68
On-site exposure cost	$ 18.68
On-site cleanup cost	$581.20
Replacement power cost	$401.84
Total cost (CDF)	$2,351.24
Total cost (LERF)	$4,810.00

Note: Costs figures are in millions

Based on the Quad Cities cost data, I estimated the annual expected cost of a CDF event and LERF event at Vermont Yankee due to the proposed uprate, using the ΔCDF and ΔLERF probabilities calculated by Witness Burns in his rebuttal testimony (page 20). The calculations are shown below:

Expected CDF Cost$_{\textbf{per year}}$ = (ΔCDF probability$_{\text{per year}}$) x (CDF event cost)

(.000000316) x ($2,351,240,000) = $742 per year

Assuming the uprate is in service by 2005 and continues through the end of the current operating license, this yearly cost would be multiplied by 8 to calculate the cost over the remaining license period. This figure is $5,936 in nominal dollars.

Expected LERF Cost$_{\textbf{per year}}$ = (ΔLERF probability$_{\text{per year}}$) x (LERF event cost)

(.000000117) x ($4,810,000,000) = $562 per year

Assuming the uprate is in service by 2005 and continues through the end of the current operating license, this yearly cost would be multiplied by 8 to calculate the cost over the remaining license period. This figure is $4,496 in nominal dollars.

Based on this approach, it appears that the probability-weighted expected costs of a severe event due to the uprate are rather small in comparison with the benefits noted earlier.

Q21. Witness Burns testifies that the uprate at Vermont Yankee is expected to reduce post-uprate capacity factor by approximately 2 percentage point in the initial two years following the uprate and by 0.071 percentage points thereafter. What are the cost implications?

Response: It must be remembered that if the uprate increases net capacity by about 20% (and is also the percentage increase in net output as well), then an uprate (with the 2% reduction in capacity factor) will still result in a 17.6% increased net output relative to the pre-uprate output (at a higher capacity factor). Furthermore, to the extent that the Company is successful in continuing to achieve increases in capacity factors (as reflected in Witness Burns' testimony, Figure 6) due to improved operations and management, the post-uprate capacity factors may still exceed those prior to the uprate, even with the effects of the EPU, noted by Witness Burns.

Despite the fact that Witness Wells states that Entergy Nuclear VY is under no obligation to indemnify the purchasers under the PPA for any reduction in generation output, and that the overall trend in recent years demonstrates increased capacity factors at Vermont Yankee, DPS Witness Sherman contends that potential costs due to interruptions in the PPA should be considered in this case. Assuming that such potential costs should be considered and using Witness Sherman's illustrative figure of a $50 per MWh replacement power cost, and Witness Burns' post-uprate capacity factor adjustments, the potential market price risk is as follows:

In the years 2005 and 2006, the potential market price risk is:

(.02) (510 MW) (8760) (.55) ($50 - $42.80) = **$353,833** (nominal) per year

In years 2007 – 2012 the potential market price risk is:

(.00071)(510 MW)(8760)(.55)($50 - $42.80) = **$12,561** (nominal) per year

These costs, seen over the remaining term of the license are far outweighed by the expected benefits. Even then, given the strong likelihood that Entergy Nuclear Vermont Yankee will continue the clear trend towards increased capacity factors, my expectation is that the uprate will not result in a decrease relative to historical capacity factors. In other words, performance under the PPA is likely to increase despite any capacity factor adjustments subsequent to the power uprate. Thus, I see no evidence that warrants a PPA market risk cost to be included in the benefit-cost test.

Q22. Please summarize the costs that you have quantified regarding the proposed uprate.

Response: In addressing the theoretical cost concerns raised in this proceeding, my conclusion is that very few cost items, with very minor dollar significance (whether direct costs or externalities) are likely to be experienced by Vermonters. The only cost in my analysis that I recommend be counted against the quantified benefits is the expected cost relating to a severe accident scenario, even though the probability of this occurrence is so remote and speculative that it certainly could be discounted entirely. On a probability-weighted basis, over the remaining operating license period, these costs total $10,432.

Market risks to Vermonters stemming from uprate-related capacity factor diminution are likely to be of no financial consequence given the pronounced capacity factor improvement trend evident in recent data. To the extent that such risks are accounted for, I have provided a quantification of costs that may be associated with such market risk costs for reference purposes. This quantification demonstrates that such costs are nominal when compared to the anticipated benefits.

IV. Comparison of Benefits and Costs

Benefits: $23,850,000 yearly; or $190,800,000 over the remaining operating license period following the uprate.

Costs: $1,304 yearly or $10,432 over the remaining operating license period following the uprate.

Net Benefit: $23,848,696 yearly or $190,789,568 over the remaining operating license period following the uprate.

Q23. Does this conclude your testimony?

Response: Yes.